DUNLOP AIRCRAFT TYRES

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ISSUE 11 – OCTOBER 2022

TYRE CARE & MAINTENANCE MANUAL:

DM1172

STATEMENT OF CERTIFICATION

The technical content of this TCMM is approved under the authority of Dunlop Aircraft Tyres Ltd. and conforms to CAP533, Section A, Chapter A5-3, with reference to CAP562, Chapter 52

DUNLOP AIRCRAFT TYRES

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1.1 TCMM DM1172

This Tyre Care and Maintenance Manual (TCMM), DM1172, contains general maintenance and servicing guidance for:

- Tyres manufactured by Dunlop Aircraft Tyres
- Tyres retreaded by Dunlop Aircraft Tyres
- Tubes supplied by Dunlop Aircraft Tyres

The content of this TCMM is intended to ensure that Dunlop aircraft tyres and tubes are maintained in good condition before, during and after operation.

Where applicable, Dunlop tyre operators should always consult instructions given in the relevant Aircraft Maintenance Manual (AMM), Component Maintenance Manual (CMM) for tyres and wheels, relevant Technical Orders (TO) or Airworthiness Directives (AD), in precedence to this manual.

UK government regulation requires inclusion of a Statement of Initial Certification within this manual. Such a statement can be found on the front cover of this manual.

1.1.1 FURTHER GUIDANCE MATERIAL

In addition to this TCMM, and in addition to the AMM, CMM's, and other relevant technical material, further care and maintenance guidance can be found at the following:

1.1.1.1 SAE INTERNATIONAL

Available from: https://saemobilus.sae.org/

Document	Description
ARP5265	Minimum Operational and Maintenance Responsibilities for Aircraft Tire Usage
ARP6225	Aircraft Tire Inspection – In-Service Removal Criteria
ARP6307	New and Newly Retreaded Tire Appearance

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1.2 GENERAL CONTACT DETAILS

If you require information about publications, spares, or support engineering, please contact:

AMERICAS	EMEA, CIS	APAC
Dunlop Aircraft Tires Inc. 205 Enterprise Way, Mocksville, NC 27028, United States Telephone: +01 336 252 2801	Dunlop Aircraft Tyres Ltd. 40 Fort Parkway, Birmingham, B24 9HL, United Kingdom Telephone: +44 (0)121 384 8800	Dunlop Taikoo Aircraft Tyres Ltd. No.2 Taikoo Road, Quanzhou Export Processing Zone, Cizao, Jinjiang, 362200, Fujian, China Telephone: +86 595 8593 1007
Cage Code: 7JGG5	Cage Code: U8018	

For general enquiries, email: Enquiries@dunlopatl.co.uk

Website: www.dunloparcrafttyres.com

1.3 IN-SERVICE SUPPORT CONTACT DETAILS

For contact details, by country: https://www.dunlopaircrafttyres.co.uk/find-contacts/

For global in-service support, email: TechnicalSupportGroup@dunlopatl.co.uk

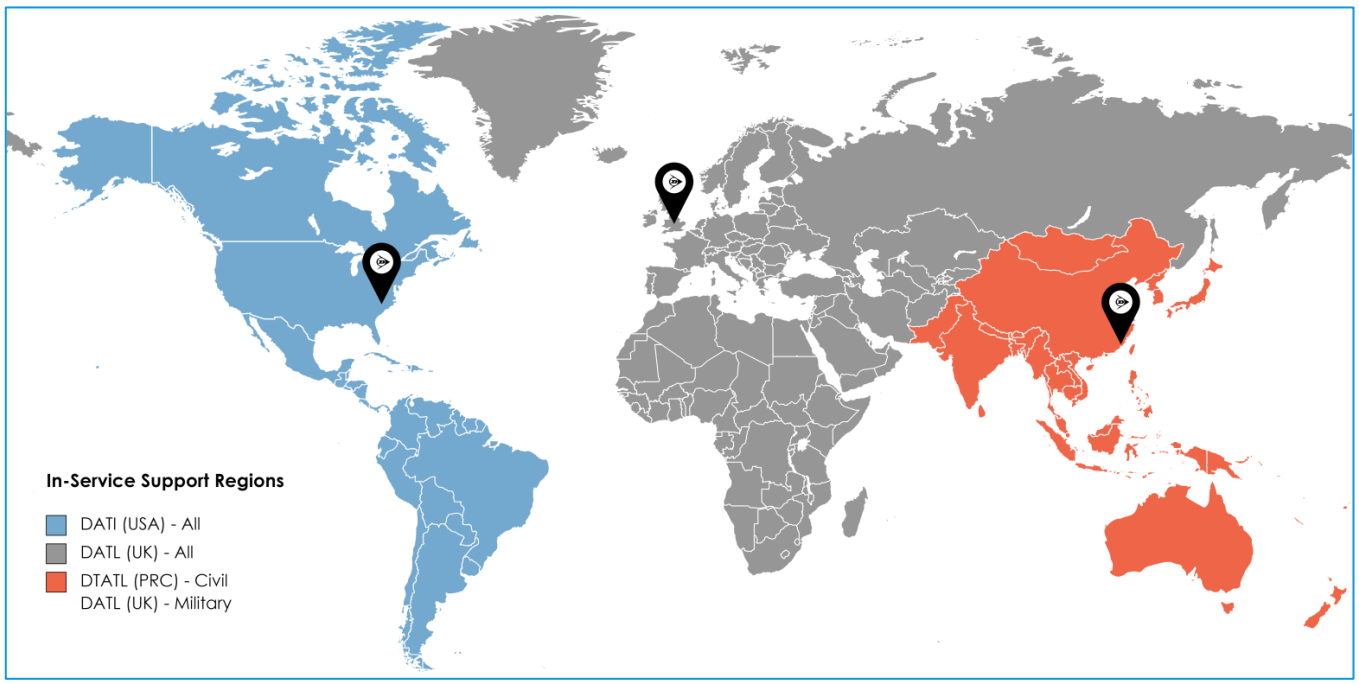

Figure 1 – In-Service Support Regions

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1.4 ABBREVIATIONS

AC	Advisory Circular
AD	Airworthiness Directive
AOG	Aircraft On Ground
APAC	Asia Pacific
AMM	Aircraft Maintenance Manual
CAA (UK)	Civil Aviation Authority (UK)
CAAC	Civil Aviation Administration of China
CAGE	Commercial and Government Entity
CIS	Commonwealth of Independent States
CMM	Component Maintenance Manual
CTSO	Chinese Technical Standard Order (CAAC)
DATI	Dunlop Aircraft Tires Incorporated (USA)
DATL	Dunlop Aircraft Tyres Limited (UK)
DTATL	Dunlop Taikoo Aircraft Tyres Limited (PRC)
EASA	European Aviation Safety Agency
EMEA	Europe, Middle East & Africa
ETSO	European Technical Standard Order (EASA)
FAA	Federal Aviation Administration
FIFO	First In First Out
FOD	Foreign Object Debris
ITF	Inter Tread Fabric
MLG	Main Landing Gear
NATO	North Atlantic Treaty Organisation
NDT	Non-Destructive Testing
NSN	NATO Stock Number
NLG	Nose Landing Gear
P/N	Part Number
PR	Ply Rating
RTO	Rejected Take-Off
S/N	Serial Number
TCMM	Tyre Care & Maintenance Manual
TO	Technical Order
TSO	Technical Standard Order (FAA)
UKTSO	UK Technical Standard Order (CAA (UK))
WTL	Worn To Limits

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2.1 TYRE AREAS

Figure 2 – Tyre Areas

2.1.1 TREAD

The wearing portion of the tyre typically marked on Dunlop's as the area between one or more continuous decorative lines engraved in the upper sidewall.

The tread area can be broken into two areas as follows:

- Crown – the central portion of the tread, on which the tyre makes full contact with the ground.
- Shoulder – the outer portions of the tread, typically running between the outer most tread groove and the sidewall.

2.1.2 SIDEWALL

The side of the tyre, extending from the upper most decorative lines to the lowest most, located just above the bead area in proximity of the wheel flange.

2.1.3 BEAD

The area of the tyre extending down from the lower decorative lines to the bead toe (see below).

2.1.4 INNER LINER

The interior surface of the tyre, running from one bead toe to another.

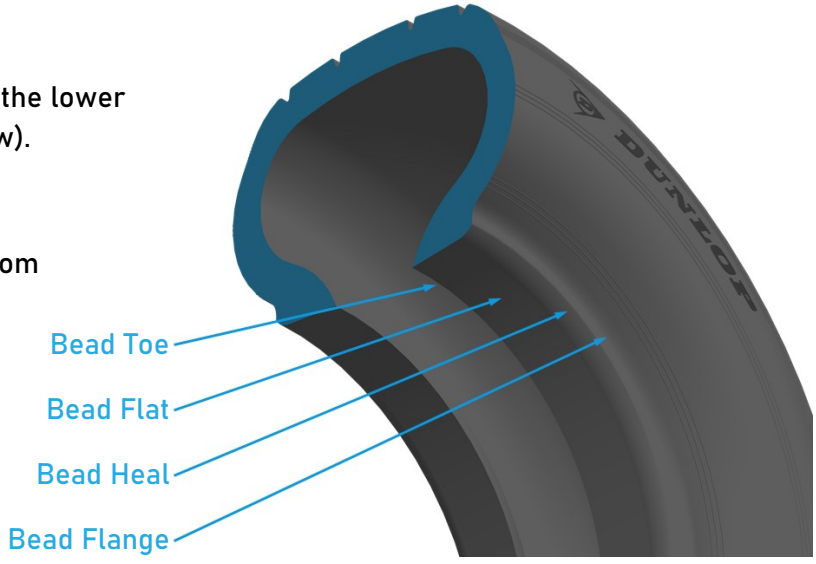

Figure 3 – Tyre Bead Detail

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2.2 TYRE MARKINGS

This manual gives examples of the various tyre markings moulded into Dunlop tyres, across various aircraft and tyre applications.

Such markings typically include:

- Tyre size
- Dunlop part number
- Serial number
- Ply rating
- Load rating
- Speed rating
- Vent hole markings
- Balance point mark
- Qualification markings

Other typical markings, based on specific tyre operation, can include:

- Military markings
- Retread markings

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2.2.1 TYPICAL TYRE MARKINGS

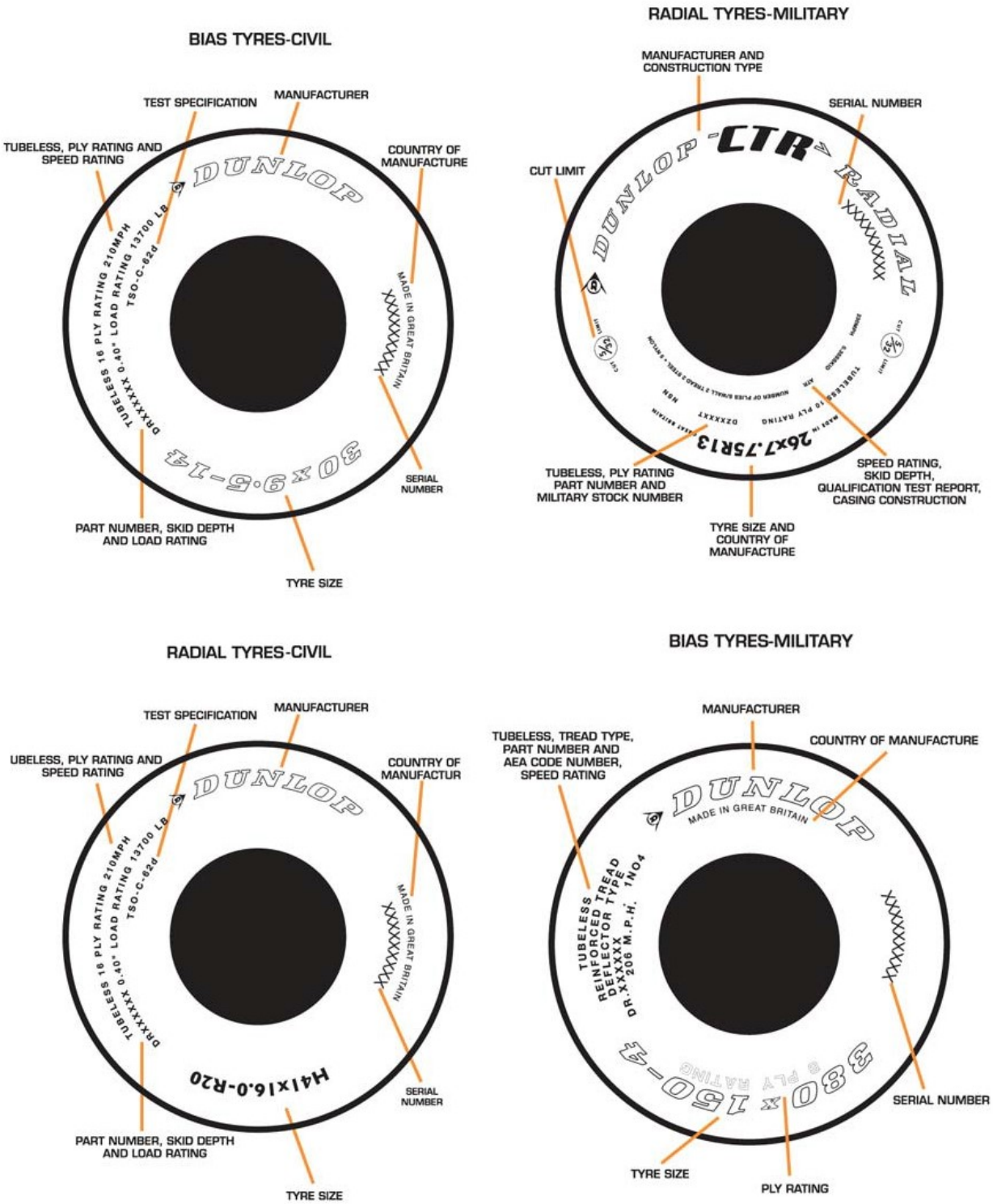

Figure 4 – Typical Tyre Markings

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2.2.2 TYRE MARKING DETAILS

2.2.2.1 TYRE SIZE

Tyre sizes are typically given in imperial units (inches), although some tyres sizes are described in metric (millimetres).

Tyre sizes are composed of three key tyre measurements, A, B & C as illustrated to the left of this page.

These measurements are combined with certain common symbols, to create tyres sizes in the following common variations:

- A e.g. 44"
- B-C e.g. 8.50-10
- A×B e.g. 49×17
- A×B-C e.g. 34×10.75-16

For radial tyres, the "-" which separates B & C is replaced by an "R", e.g. 1400×530R23

An "H" is prefixed to the tyre size for tyres sized to wheels which have a flange to flange distance of between 0.60-0.70 × the section width of the tyre, e.g. H44.5×16.5R21

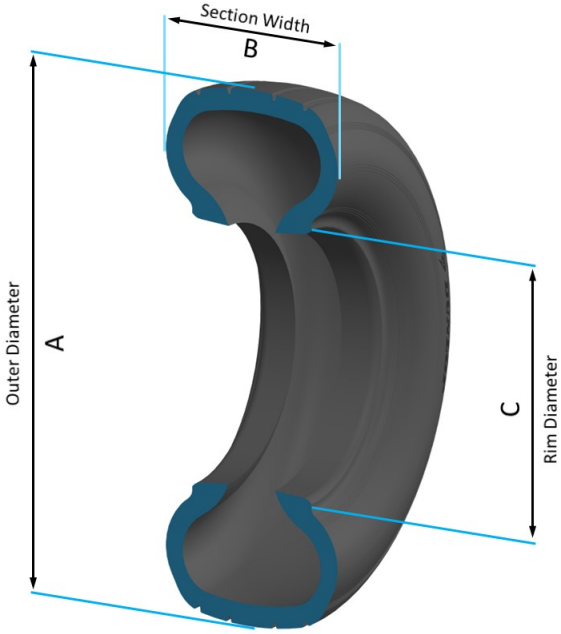

Figure 5 – Tyre Size Measurements

2.2.2.2 PART NUMBER

Dunlop part numbers are alphanumeric and consist of 4 separate components: ABCD

A is 2 digit alpha code, denoting the tyre classification.
DR and DZ are the most common, but various other codes exist throughout Dunlop's historic range.

- DR - Bias, ribbed tread
- DZ - Radial, ribbed tread

Less common variants still in current use include:

- DA - Bias, twin contact tread
- DB - Bias, serrated ribbed tread
- DS - Bias, smooth tread
- DD - Bias, dimpled tread
- DRR - Bias, fabric reinforced tread

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B is a 2 or 3 digit numeric code, allocated by Dunlop to denote a tyre size.

C is a 2 digit numeric code, denoting a specific tyre design within the previous AB code.

D is optional; if left blank it denotes a tyre requiring an inner tube, with a "T" used to denote a tyre of a tubeless design.

2.2.2.3 SERIAL NUMBER

Each Dunlop tyre has a unique numeric serial number (S/N), formed of 8 digits: 11222333

The first 2 digits, 11, represent the year of manufacture (e.g. 2019 would be given as 19)

The next 3 digits, 222, represent the Julian day of manufacture for that year. (e.g. 25th February would be given as 056)

The last 3 digits, 333, are a unique number to identify each individual tyre manufactured.

2.2.2.4 PLY RATING

Ply Rating (PR) is an index of tyre strength from which a rated inflation pressure and its corresponding maximum load rating are determined for the specific tyre size.

2.2.2.5 LOAD RATING

Load rating is the maximum permissible static load for the tyre when inflated to its maximum rated pressure.

2.2.2.6 SPEED RATING

Speed rating is the maximum permissible ground speed at which the tyre has been tested in accordance with its qualification.

2.2.2.7 VENT HOLE MARKINGS

Vent holes (also called awl holes or awl vents) are small holes made in the lower sidewall of the tyre, found just above the wheel flange area.

These holes are made to an appropriate depth within the tyre and provide for the release of inflation gas which will slowly diffuse into the tyre over the course of typical operation. Without these holes, diffused gas could lead to the generation of internal separations within the tyre.

Vent holes are marked with a coloured indicator, so that their location is visually identifiable on the tyre, with:

- Tubeless tyre vents marked in green
- Inner tube tyre vents marked in grey/silver

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2.2.2.8 BALANCE POINT MARK

Each Dunlop tyre is statically balanced, with a red indicator marked on the sidewall to identify the light-point.

For MLG tyres only, should the balance point mark be missing the tyre S/N can be used in lieu of the balance point mark. All NLG tyres should possess a balance point mark.

If marked for balance, inner tubes will use a red stripe to identify the heavy-point (often in line with the valve). Unless otherwise instructed by any relevant AMM/CMM, the heavy point on any inner tubes should be installed to align with the tyre balance point mark.

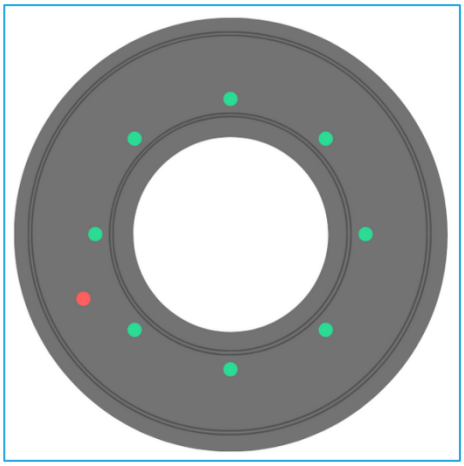

Figure 6 – Awl Vent & Balance Marks

2.2.2.9 QUALIFICATION MARKINGS

Dunlop tyres are typically marked with a reference to the qualification standard used to qualify the tyre.

The most common marking is the relevant Technical Standard Order (TSO), complete with the relevant revision at time of qualification. Various TSO's are in common use, including European (ETSO), Chinese (CTSO) and British derivatives (UKTSO).

Qualification markings can also include aircraft OEM part numbers, specification numbers, qualification report numbers, or other relevant references.

2.2.2.10 MILITARY MARKINGS

Tyres designed for military applications often contain additional markings, per any relevant military specification. The most common additional military markings include:

- NATO stock number (NSN)
- Commercial and Government Entity (CAGE) code
- Cut limit indicator
  - This indicates the allowable depth for cuts, measured in 1/32nds of an inch, from the bottom of the nearest groove in the vicinity of the cut
- Max wear limit indicator
  - This indicates the maximum number of fabric layers that may be exposed before the tire must be removed from service

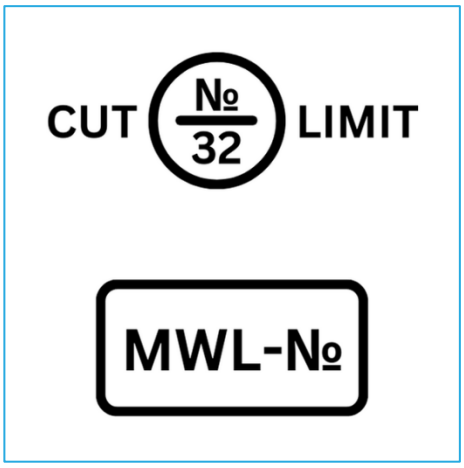

Figure 7 – Cut and Max Wear Limits

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2.2.2.11 RETREAD MARKINGS

Tyres retreaded by Dunlop, including tyres not originally manufactured by Dunlop, are marked with additional information per the relevant revision of FAA AC 145-4A.

Dunlop marks retread information at the tread edge, and on the sidewall in a retread panel:

Table 1 – Example of Retread Engraving Panel (Sidewall Positioned)

Customer Name			
Original Tyre P/N			Ply Rating
Retread Code	Outgoing R Level	Retread Date	Plant Code
Original Tyre Qualification Marking №1		Original Tyre Qualification Marking №2	

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2.3 TYRE CONSTRUCTION

2.3.1 BIAS TYRES

A tyre whose casing plies are laid at alternate angles, substantially less than 90° to the centreline of the tread.

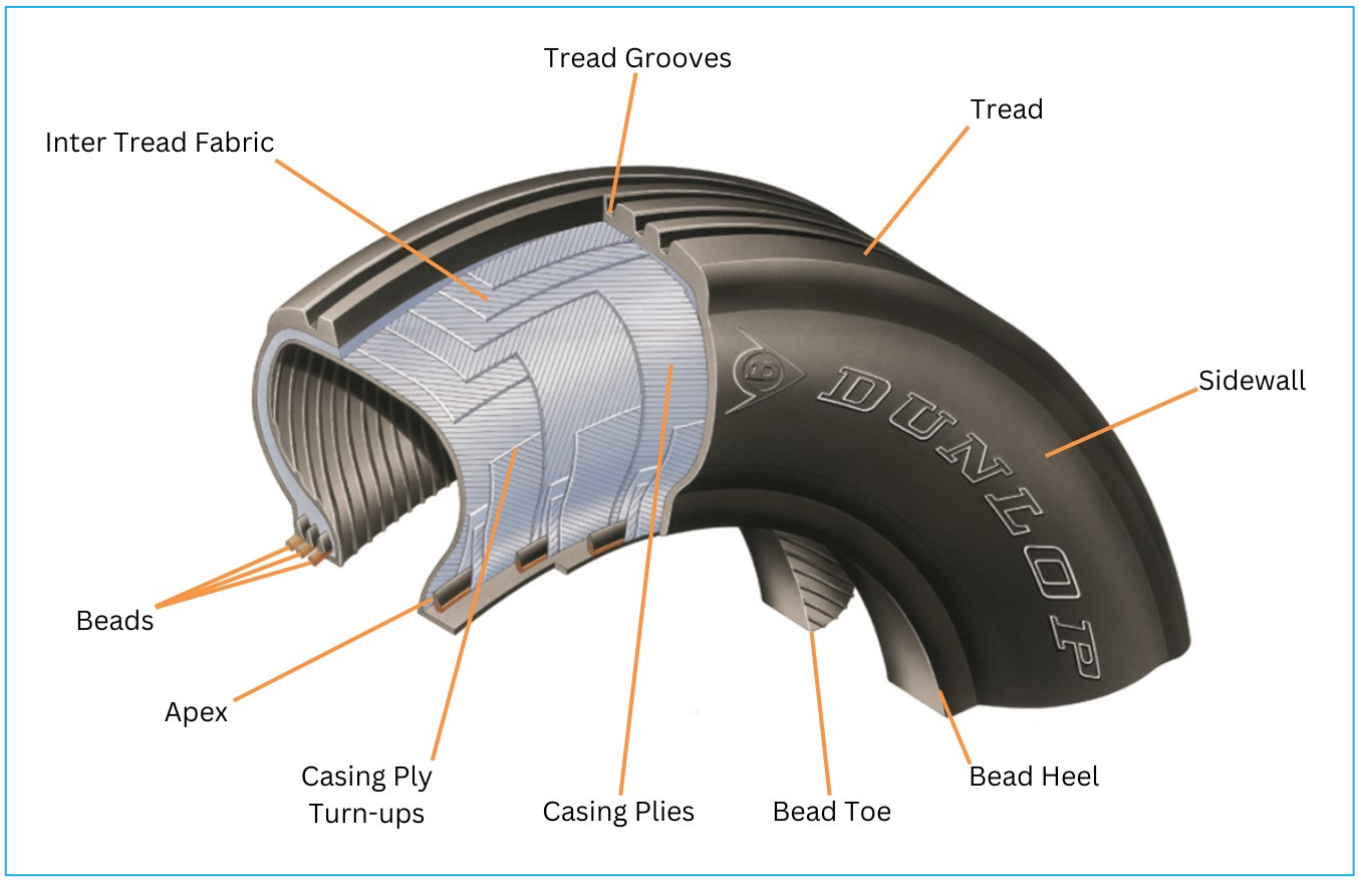

Figure 8 – Bias Tyre Construction

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2.3.2 RADIAL TYRES

A tyre whose casing plies are laid at approximately 90° to the centreline of the tread, further supported by a circumferential belt.

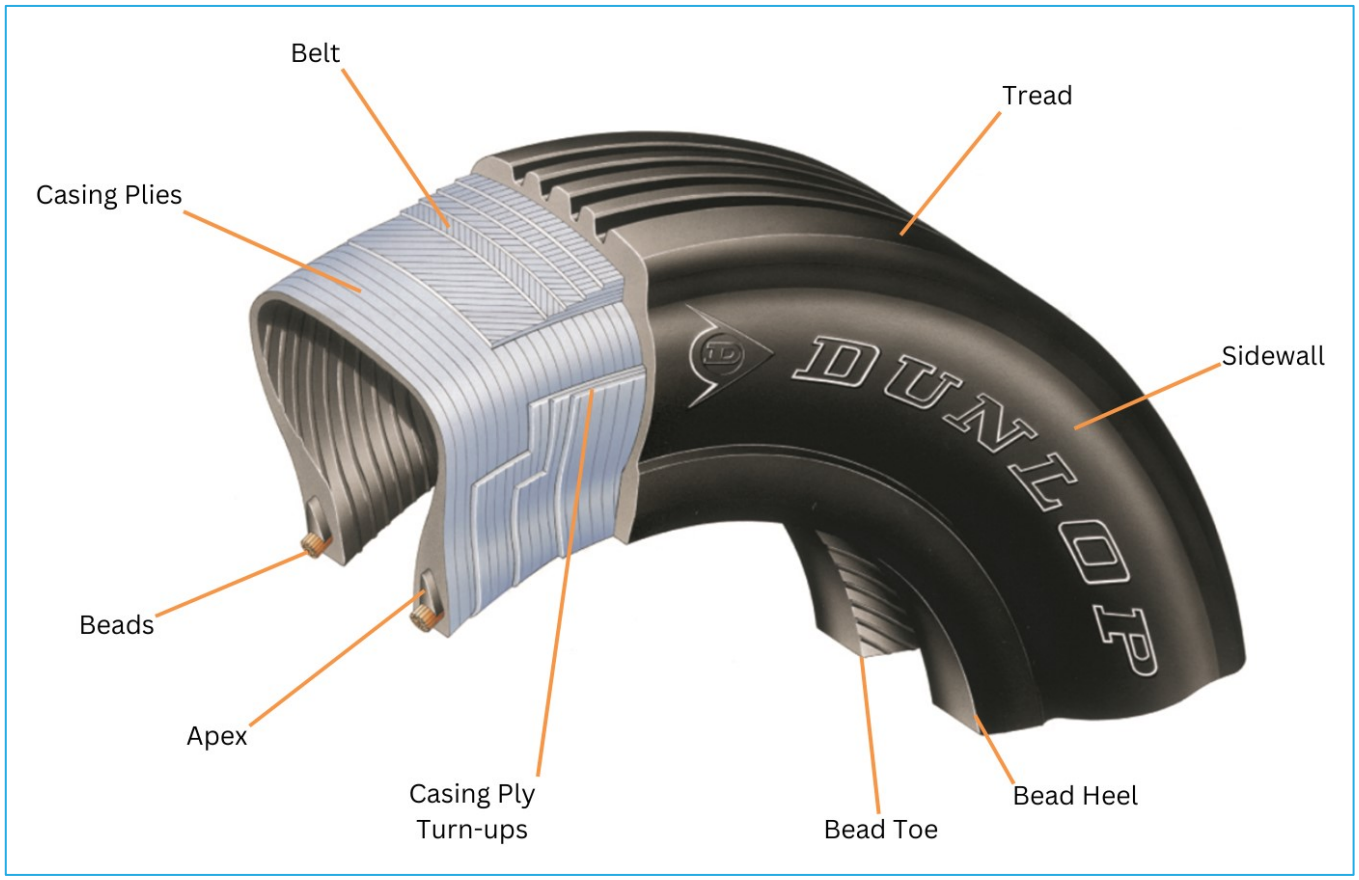

Figure 9 – Radial Tyre Construction

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2.3.3 TYRE COMPONENTS

2.3.3.1 TREAD

The rubber compound fit to the circumference of the tyre. This is the compound in direct contact with the ground, and is formulated for resistance to abrasive wear, cutting, chunking and heat.

Treads are typically grooved, with one or more circumferential tread grooves moulded into the contour of the tread. The depth of these tread grooves is referred to as the "skid depth" of the tyre. Each circumferential block of tread, as separated by the tread grooves, are referred to as "tread ribs".

2.3.3.2 INTER TREAD FABRIC (ITF)

Tyres can include an ITF, a layer of fabric reinforcement placed immediately under the tread. These are also referred to as tread reinforcement layers or protector plies.

The purpose of an ITF is to provide additional protection to the casing from damage inflicted to the tread during operation. ITF can also provide added stability to the tread, especially under high speed applications.

On tyres which can be retreaded the ITF can also act as a maximum wear indicator.

Some tyres may incorporate ITF layers within the wearing portion of the tread. These tyres are referred to as fabric reinforced tread tyres and are typically denoted by a Dunlop part number starting "DRR".

2.3.3.3 SUBTREAD

A thin layer of rubber compound separating ITF from the casing.

For tyres designed to be retreaded the subtread allows for the removal of worn tread, including the original ITF, and provides an effective interface for newly applied retread components.

2.3.3.4 CASING

A collective term for the main structural elements of the tyre. The casings of bias and radial tyres differ, but contain some common components. Casing components common to both bias and radial tyres are:

- Casing Plies
- Chafers (Fabric and/or Rubber)
- Beads
- Apexes
- Inner Liner
- Sidewalls
- Chines

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2.3.3.5 CASING PLIES

Fabric layers which provide the primary strength in bias tyres and a critical component of the primary strength in radial tyres. Casing plies are typically wrapped around the beads and run from one side of the tyre to the other. The edges of the casing plies wrapped around the beads are referred to as ply turn-ups.

By wrapping multiple layers of casing plies around one or more beads they act to retain the inflation pressure of the tyre.

2.3.3.6 CHAFERS (FABRIC AND/OR RUBBER)

Positioned at the bead flange, chafers are formed of either non-structural fabric layers and/or of rubber compounds. Their role is to protect the casing plies from abrasion with the wheel, or from damage caused by assembly or disassembly of the tyre to the wheel.

2.3.3.7 BEADS

Bundles or coils of wire which help anchor the tyre to the wheel and around which the casing plies are wrapped (turned up), see Figure 8 and Figure 9.

2.3.3.8 APEXES

Rubber volumes positioned directly above the beads to manage the shape taken by casing plies as they wrap around the beads.

2.3.3.9 INNER LINER

The rubber compounds covering the inside of the tyre, running between the bead toes. These components protect the inside of the casing and allow for the attachment of balance batches, as required to bring tyre into an acceptable level of static balance.

In tubeless tyres these compounds also limit the loss of inflation gasses from an inflated tyre and prevent the need to install an inner tube.

2.3.3.10 SIDEWALLS

The rubber compounds covering the outside of the tyre, running between the bead area and the tread. These compounds protect the casing and provide space for tyre markings, which are commonly engraved onto the sidewall.

2.3.3.11 CHINES

A contoured rubber volume at the top of the sidewall designed to alter the deflection of water from the tyre, typically to ensure water is directed away from rear fuselage mounted engines. Typically found only on NLG tyres, incorporated into one or both sidewalls.

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2.3.3.12 BELTS

Fabric layers which provide a critical component of the primary strength in radial tyres. Running circumferentially around the tyre, belt layers restrain radial growth and offer greater stability to the tread, often resulting in improved performance over bias tyres.

2.3.4 RETREADED TYRES

Retreaded tyres are those where the tread or tread and sidewall is replaced with a new components to enable its return to service. Retreaded tyres must be carefully evaluated to ensure remain structurally sound before and after the retread process. Dunlop utilises various NDT methods, including visual inspection, air needle and shearography to ensure all finished retread tyre remain serviceable.

During the retread process, Dunlop will remove any remaining tread and any ITF. This process will leave an extremely rough texture across the tread area, referred to as the rasp surface. At the edges of the rasp surface a less textured finish is applied, referred to as the buff surface.

The process of applying both the rasp and buff surfaces may remove previous sidewall markings, and some buff surface may be visible on the sidewall of finished retread tyres (see below).

Figure 10 – Example Retreaded Tyre Appearance

Once rasped and buffed a new subtread, ITFs and tread is added to the tyre. The retread tread pattern can be of a different profile, or of a different skid depth to the original casing. Changes from the original tread can be made to optimise tyres performance, and are subject to dedicated certification and approval by the relevant authorities and airframer, as required.

Dunlop retreads both original Dunlop tyres, and tyres produced by other manufactures. This is referred to as “cross retreading”, and is common practice within the aircraft tyre industry. Dunlop only cross retreads bias tyres, with the retreading of radial tyres limited to the original tyre manufacture.

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3.1 INTRODUCTION

Aircraft tyres can be damaged accidentally during transportation, when they are received or if they are kept in unsuitable conditions in storage. To keep the tyres serviceable it is recommended that the procedures in this section are followed.

3.2 RECEIVING TYRES

- Examine tyres for damage which could have occurred during transportation.
    - Tyres with small damage may still be serviceable, tyres must be considered unserviceable if any damage exceeds the limits specified in 5.4.

If you are unsure about the serviceability of a tyre, contact Dunlop for technical support.

3.3 STORING TYRES

The following conditions should be maintained to sustain the quality and ensure continued serviceability of Dunlop tyres:

- Keep tyres protected from high levels of:
    - Oxygen, ozone, direct sunlight
- Keep tyres in conditions which are:
    - Cool, dark, dry, clean

To support the above, consider the following factors:

- Protect from oxygen and ozone:
    - Do not keep tyres where they will be in an air current. Air currents can subject tyres to higher levels of oxygen and ozone gas
    - Do not keep tyres near electrical equipment (such as generators, fluorescent lights, motors or photocopiers) as these can be a source of ozone gas
- Protect from direct sunlight, keep in the dark:
    - Do not keep tyres directly in sunlight or under ultraviolet light
- Keep cool:
    - It is advisable to maintain storage temperature between 0°C & 32°C (32°F & 90°F). Ideal temperatures are between 15°C & 25°C (59°F - 77°F)
    - It is advisable to maintain storage humidity of between 40% & 70%
    - Keep tyres away from known heat sources (hot pipes, radiators)
- Keep dry:
    - Keep tyres away from any sources of or standing water to prevent prolonged tyre exposure to water
- Keep clean:
    - Keep tyres away from contamination such as oils, greases, hydraulic fluids, or solvents

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3.3.1 TYRE SHELF LIFE

Dunlop does not mandate a maximum shelf life for its tyres, so long as the storage conditions of this manual are met. However, Dunlop recommends that tyres are used in First In First Out (FIFO) basis, based on the original tyre manufacture or retread date.

Manufacture date for new tyres can be identified based on tyre serial number, as explained in 2.2.2.3. Retread date will be engraved onto all retreaded tyres, as explained in 2.2.2.11.

3.3.2 STORAGE INSTRUCTIONS – SERVICEABLE TYRES

Wherever possible, keep tyres stored on their treads, not on their sidewalls. This prevents distortion of the tyre which may lead to a reduction of the bead to bead width. This will help prevent potential problems assembling or inflating the tyre on the wheel.

Note; this is especially applicable to radial tyres, which have more flexible sidewalls than bias tyres.

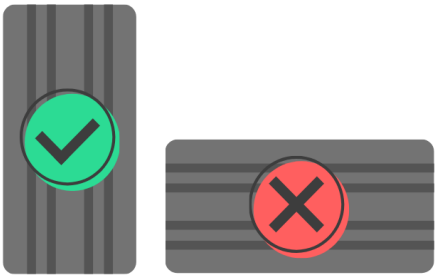

Figure 11 – Ideal Tyre Storage

3.3.2.1 SIDEWALL STORAGE

If necessary for transportation or storage, and only where it is not possible to store tyres on their tread, bias tyres may be stacked on their sidewalls. Transportation or storage in this condition should be kept to a minimum, and Dunlop advises tyres not be stored in this condition for any longer than 30 days maximum.

The number of tyres stacked on their sidewalls should be limited by nominal tyre diameter as follows:

- ≤ 39" outer diameter: 4 maximum
- >39" outer diameter: 3 maximum

If tyres are stacked on their sidewalls for longer than 30 days, Dunlop recommends rotating the entire stack of tyres, as illustrated to the right:

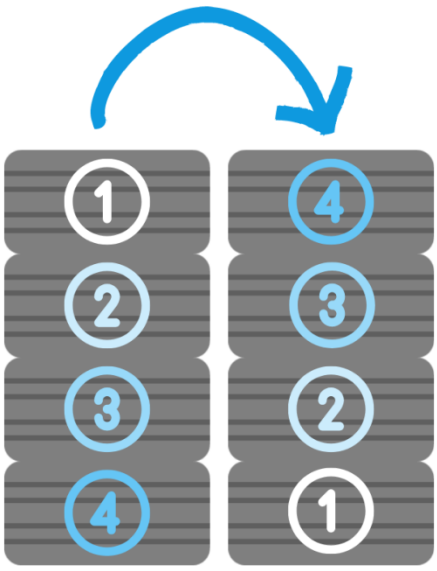

Figure 12 – Sidewall Storage Rotation

However, Dunlop recommends the following tyres are never stacked on their sidewalls:

All Radial Tyres	8.50-10	9.00-6	11.00-12	17.5×6.25-6
20.00-20	24×7.7	28×9.00-12	H31×9.75-13	32×10.75-14
32×11.50-15	33.5×10.75-15	34×10.75-16	H34.5×12.0-14	34×14.0-14
37×11.75-16	37×14.0-14	42×15	43×15.5-17	56×20.0-20

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3.3.3 STORAGE INSTRUCTIONS – TYRES ON WHEEL

Dunlop recommends decreasing the pressure of an installed tyre which is to be kept in storage for more than 7 days, or if the tyre and wheel assembly is to be transported:

- Decrease tyre pressure to 25% of the operational pressure, or to 40 psi (2.76 bar), whichever is lowest.
- Tyres can be stored at full service pressure for up to 12 months maximum, if operations dictate.

Dunlop advises that tyres are marked with storage pressure, using either chalk or wax crayon, to reduce risk of installation of incorrectly pressurised tyres.

Note; if a tyre has been mounted, but unused, it is permissible to dismount (disassemble) the tyre from the wheel. Dismounted tyres can be remounted (reassembled) onto the same or another wheel, providing the tyre meets the standards used when installing an unused tyre.

Dunlop does not require dismounted tyres to be returned for recertification before they are remounted, unless they fail to meet the standards used when installing an unused tyre.

3.3.4 STORAGE INSTRUCTIONS – WORN TYRES

3.3.4.1 TYRES FOR RETREADING

Tyres that are to be considered for retreading should be stored in the same manner as serviceable tyres (see section above).

3.3.4.2 TYRES FOR SCRAP

Tyres that are designated for scrap should be:

- Segregated from all other tyre stock
- Stored in accordance with all local regulations and guidance
- Stored with consideration to potential associated fire risk for large quantities of tyres and the difficulties faced in extinguishing a large scale rubber fires.

Tyres disposed of directly by customers should:

- Follow all local regulations and guidelines

Tyres returned to Dunlop for disposal will be:

- Reworked, recovered or disposed of in whichever way is most environmentally considerate

3.3.5 LONG TERM STORAGE

If tyres are to be stored for a long time, it is advised that they are rotated by 90° at least once every 3 months, for the duration of their storage.

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4 FITMENT & ASSEMBLY CONTENTS

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⚠ CAUTION

Exercise caution at all times around inflated aircraft tyres. Aircraft tyres are typically inflated to high pressures and if improperly handled can pose a risk of serious or fatal personal injury, and/or damage to aircraft and equipment.

Aircraft tyres should be installed only as per the applicable instructions, with the correct equipment and operator training.

Aircraft tyres must only be inflated with a suitably calibrated and accurate pressure source. No tyre must ever be inflated to above its maximum operating pressure, as per the applicable instructions.

4.1 TYRE MOUNTING INSTRUCTIONS

Aircraft tyres should only be mounted (assembled onto an applicable aircraft wheel, with or without an inner tube), per the specific instructions provided from the original aircraft manufacturer or original wheel manufacturer.

Always refer to the applicable AMM's, CMM's or other relevant documentation as applicable.

4.2 INITIAL INFLATION

Newly inflated tyres can expand for up to 12 hours after inflation. This decreases the internal pressure. For up to 24 hours after inflation, diffusion of gas through the inner liner into the casing can also occur. After the initial 24 hours any further diffusion should decreases to a constant, low level.

As standard, Dunlop recommends allowing up to a minimum of 12 hours after initial inflation for the tyre to stretch. Check pressure after a minimum of 12 hours with a calibrated pressure gauge. If necessary, reinflate the tyre as described in AMM to its specified operational pressure.

24 hours or more after completing the stretch check, measure the pressure again. The assembly should not lose more than 5% of the previously set inflation pressure. Should any pressure loss exceed the acceptable limits, test the assembly by water check to find the cause of the leak. If the cause cannot be found, dismount the tyre, as given in the AMM, and remount on a different serviceable wheel. Inflate the tyre and check for any further pressure loss.

If pressure loss persists, check the wheel for correct assembly. If correctly assembled remove tyre and return to Dunlop for investigation.

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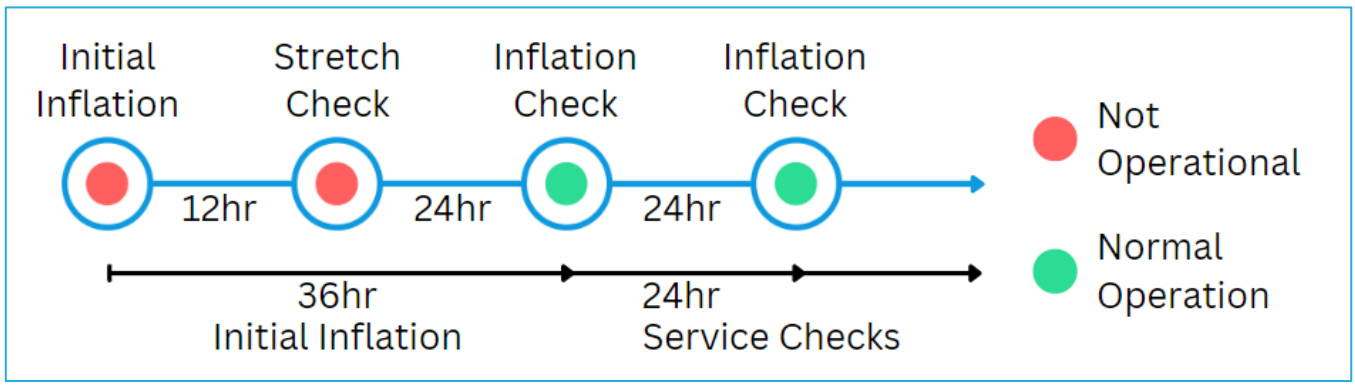

Figure 13 – Initial Inflation Pressure Schedule

4.2.1 EMERGENCY CONDITIONS

Under emergency conditions tyres can enter into service without completing the standard stretch and inflation pressure checks. This should always be avoided unless absolutely necessary, typically only to avoid an AOG situation.

Under these conditions, inflate the tyre to the unloaded service pressure and leave it for at least 1 hour minimum. The tyre/wheel assembly and the inflation valve should then be checked for abnormal leakage. This can be achieved by spraying these components with a soap solution and checking for:

- The soap solution bubbling between the tyre and wheel, or
- A constant stream of bubbles being produced at the tyre vents

If an abnormal leak is found the tyre/wheel assembly should be disassembled and reassembled in accordance with the AMM/CMM. If there is no abnormal leakage, inflate the tyre to 105% of the unloaded service pressure and place the tyre into service (+5% service pressure is to account for tyre stretch).

Tyre pressure must be checked, and reinflated as necessary, before every flight within the following 48 hours, and at least once every 24 hours.

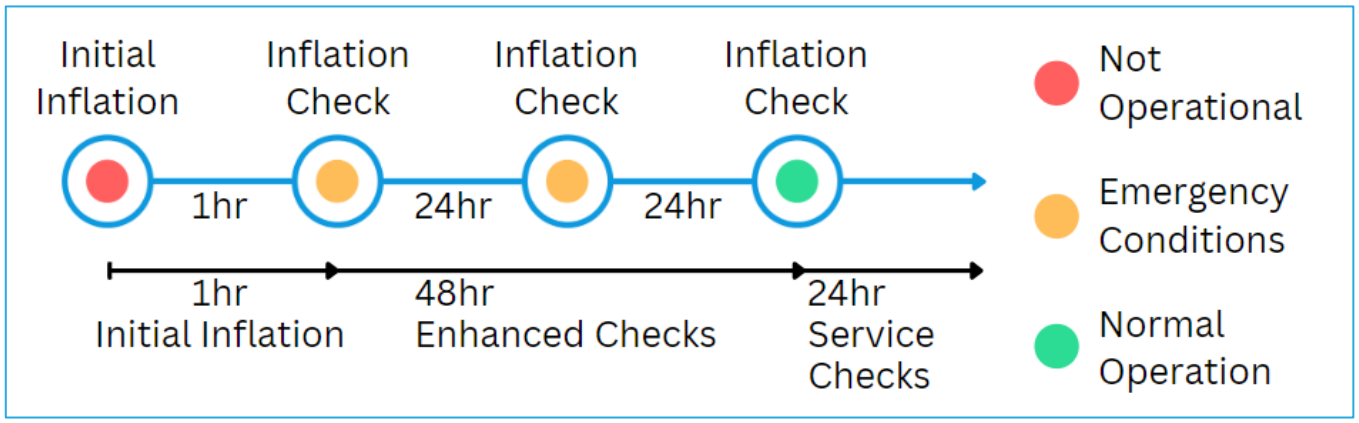

Figure 14 – Emergency Inflation Pressure Schedule

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⚠ CAUTION

Exercise caution at all times around inflated aircraft tyres. Aircraft tyres are typically inflated to high pressures and if improperly handled can pose a risk of serious or fatal personal injury, and/or damage to aircraft and equipment.

Aircraft tyres should be installed only as per the applicable instructions, with the correct equipment and operator training.

Aircraft tyres must only be inflated with a suitably calibrated and accurate pressure source. No tyre must ever be inflated to above its approved operating pressure, as per the applicable instructions.

Always approach tyres at a 45° angle from the tread, to minimise the risk of injury from tyre bursts.

5.1 INSPECTION OF MOUNTED TYRES

5.1.1 INTRODUCTION

This section gives additional guidance for the inspection and check of tyres installed on aircraft. Use these instructions only where no other instructions are provided within the relevant AMM, CMM or alternate documents.

Instructions provided in this section are intended to ensure:

- Tyres are safe for flight
- Unserviceable tyres with wear or damage beyond acceptable limits are removed

5.1.2 RE-CERTIFICATION OF TYRES

If a tyre has been mounted but unused, it is acceptable to reinstall the tyre without returning it to Dunlop for re-certification, provided the tyre meets all relevant standards for the installation of unused tyres.

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⚠ CAUTION

Exercise caution at all times around inflated aircraft tyres. Aircraft tyres are typically inflated to high pressures and if improperly handled can pose a risk of serious or fatal personal injury, and/or damage to aircraft and equipment.

Always use a pressure gauge which is accurately calibrated to measure tyre pressure. Incorrect tyres pressures can increase the rate of wear to both the structure of the tyre and to portions of the tread. Excess wear can lead to failures; with can be dangerous to personnel and rick damage to equipment or the aircraft.

Do not use tyre deflection to estimate tyre pressure.

5.2 INFLATION PRESSURE

5.2.1 INTRODUCTION

Tyres on aircraft must be kept at the correct operating pressure. An increase or decrease in pressure from the correct specified operational pressure can cause deterioration of a tyre, effecting the life and safety of the tyre.

An under inflated tyre (in which the pressure is too low) will have an increased deflection and will be overworked during aircraft operation on the ground, resulting in excess heating of the tyre. Such overwork and excess heating can create separations within the structure of the tyre and can lead to tread separation or structural failure.

Under inflated tyres will also wear unevenly, with excess wear in the shoulder area.

An over inflated tyre (in which the pressure is too low) will have a decreased deflection and will wear unevenly, with excess wear in the crown area.

Both under and over inflated tyres will wear unevenly, leading to a reduction in the number of landings achieved by the tyre before removal. To get the highest performance from an aircraft tyre always ensure it is properly inflated.

5.2.2 INFLATION PRESSURE CHECKS

Over time aircraft tyres will lose a portion of their inflation pressure. Typical diffusion of gas through the inner liner of the tyre can result in a reduction of up to 5% of operational pressure, over the course of 24 hours.

Dunlop recommends all operators measure tyre pressure at least every 24 hours, and before the first flight of the day. Within each 24 hour period a decrease of up to (and including) 5% of the operational pressure is considered acceptable.

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If measuring tyre pressure at intervals of less than 24 hours, a decrease of 5% will not be acceptable. For check intervals of under 24 hours, the acceptable pressure loss should be equal to 0.625% for every 3 hours from the previous pressure check, not to exceed 5% after 24 hours.

5.2.3 DIFFUSION FROM AWL VENTS

Diffusion of gas from the awl vent holes (marked in green or grey/silver ink) is usual, and can occur at all times. Gas bubbles from the awl vent holes are seen during leakage checks when you use a water immersion tank or an applicable spray solution.

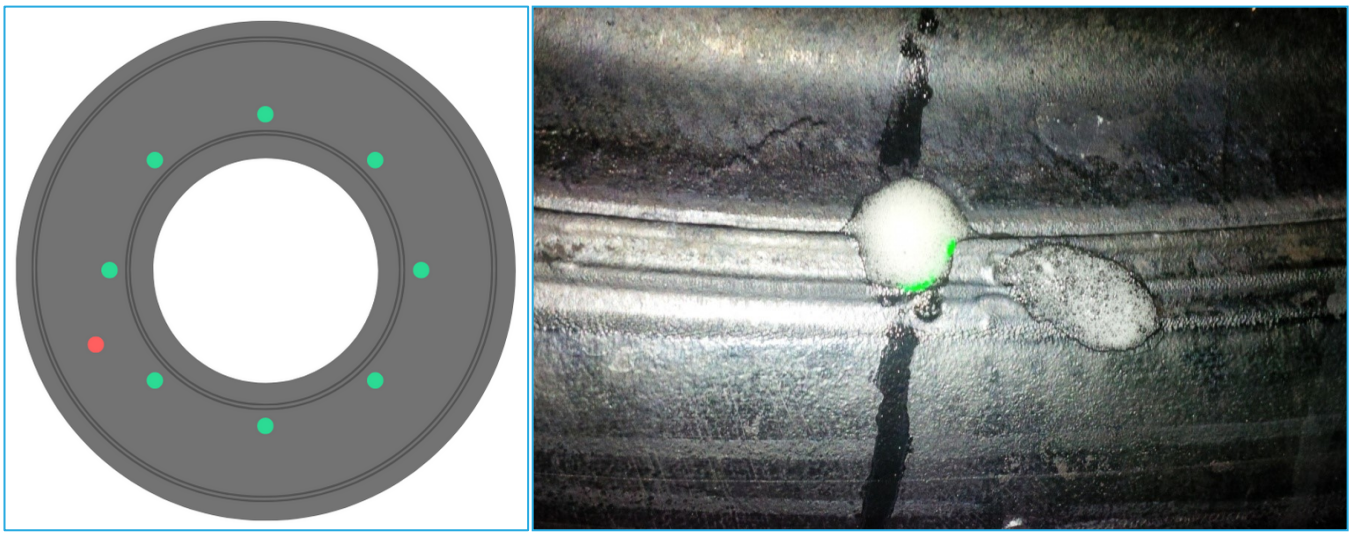

Figure 15 – Diffusion from Awl Vents

Do not reject a tyre with diffusion of gas from its awl vent holes if pressure loss is below the specified limits. The quantity of diffused gas is different for each tyre.

5.2.4 RECOMMENDED PRESSURE

To ensure optimum performance Dunlop recommends tyres be kept at the maximum operational pressure permissible. Operation of the tyre outside acceptable inflation pressure tolerances can cause deterioration of the tyre and have an adverse effect of the service life and safety of the tyre.

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5.2.5 MEASUREMENT TOLERANCES

To check tyre pressure Dunlop recommends using a gauge with a tolerance of ±0.25% of its full scale.

If there is no published guidance within the AMM, Dunlop suggests the following pressure maintenance tolerances, as guidance:

Table 2 – Dunlop Recommended Pressure Maintenance Tolerances

Inflation Pressure	Tyre Status	Recommended Maintenance
>105%	Over inflated Pressure has increased to limits greater than those permitted.	1. Decrease the pressure to the maximum of the operational range.
100-105%	Pressure optimal Pressure within optimal operational range.	No action required.
95-100%	Pressure acceptable Pressure is within acceptable limits, but not optimal.	1. Increase tyre pressure to the maximum of the operational range.
90-95%	Under inflated (minor) Pressure has decreases to limits less than those permitted for pressure decreases over 24 hours.	1. Increase pressure to maximum operational pressure. 2. Record tyre status and pressure adjustment in the Service Logbook. 3. Check pressure after 24 hours. If pressure has decreased by more than 5%, remove the wheel assembly from the aircraft to investigate the source of the leak.
80-90%	Under inflated (major) Pressure has decreases to limits less than those permitted for pressure decreases over 24 hours.	1. Remove the wheel assembly from the aircraft. 2. Increase pressure to maximum operational pressure. 3. Check pressure after 24 hours. If pressure has decreased by more than 5% investigate the source of the leak. 4. If source of leak cannot be found, replace tyre and return tyre to Dunlop for investigation.
0-80%	Flat tyre Pressure has decreased to such an extent the tyre is no longer serviceable.	1. Remove the wheel assembly from the aircraft. Where applicable also remove any other wheels installed on the same axle. 2. If source of leak cannot be found, replace tyre and return tyre to Dunlop for investigation.

Note; inflation of tyres to up to 105% of their operational pressure ensures there is sufficient inflation pressure to accommodate any tyre stretch, and to account for typical pressure loss over a 24 hour period, without the pressure dropping below the desired operational pressure.

However, regardless of Dunlop recommendation, always follow the relevant AMM stated inflation pressures.

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5.2.6 FACTORS EFFECTING TYRE PRESSURE

5.2.6.1 TYRE DEFLECTION

⚠ CAUTION: Do not use tyre deflection to estimate tyre pressure.

The load applied to a tyre will have an effect on aircraft tyre inflation. Once a tyre is supporting the weight of an aircraft the tyre pressure will typically increase by approximately 4% of operational pressure.

Note; on multi-tyre landing gear, due to how aircraft load is shared between each tyre it is possible for tyres to appear to be at the correct inflation pressure whilst incorrectly inflated. This can result from uneven tyre inflation between different tyres installed on a single landing gear.

5.2.6.2 AMBIENT TEMPERATURE

For correct and consistent measurement of tyre pressure measurement should be taken while the tyre is at ambient temperature.

After any aircraft operation, let the tyres call to ambient temperature before measuring their pressure. After an aircraft landing, tyres should be left to cool for approximately 3 hours, subject to confirmation the tyre has effectively cooled to ambient temperature.

5.2.6.3 CHANGES IN AMBIENT TEMPERATURE

Operation of aircraft between locations with differences in ambient temperature can have an effect on tyre inflation. Where a change in ambient temperature is noted, the following rules can be taken as guidance:

- An increase of 3°C results in an increase of 1% of tyre pressure.
- A decrease of 3°C results in an increase of 1% of tyre pressure.
- Any change greater than 25°C requires the tyre be measured and adjusted to ensure the correct inflation pressure.

5.2.6.4 HOT TYRES

⚠ CAUTION: Do not decrease the inflation pressure of hot tyres. Tyre pressure should be measured and maintained based on tyres at ambient temperature.

Movement of the aircraft on the ground will generate heat in the tyres. Tyres can also experience heat transmitted through the wheels and from hot brakes, from the aircraft structure, or from other heat sources such as engine/jet exhausts.

If possible, allow hot tyres to cool to ambient temperature. As stated above, tyres should be left to cool for approximately 3 hours, although this can vary based on tyre construction and size.

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Under certain operational conditions, it can be necessary to measure tyre pressure while the tyres are hot. If there is no published guidance within the AMM, Dunlop suggests the following, as guidance:

- The use of temperature compensated pressure gauges can be used to enable pressure measurement of hot tyres, only as instructed in the relevant AMM, CMM or other relevant instructions.
- If a temperature compensated pressure gauge is not available, then:
    - For landing gear with a single tyre, the tyre pressure should be equal to or greater than the specified operational pressure.
    - For landing gear with multiple tyres, where tyres are at equal temperature tyre inflation pressure should be within 5% of the highest inflated tyre.

      If not, inflate the tyre with the lowest pressure such that it matches the tyre with the highest pressure. Record the pressures both before and after the pressure check, and the ambient temperature in the service logbook. If at the subsequent pressure check, the pressure is lower in the tyre which had been previously inflated, replace the tyre if this pressure decrease is more than the specified limits in Table 2.

5.2.6.5 NATURAL TYRE COOLING

The following chart shows the typical rate of cooling for an aircraft tyre following a landing. The initial high temperature resulting from an aircraft landing decrease rapidly over the first 5-10 minutes, with subsequent cooling occurring at a far slower rate:

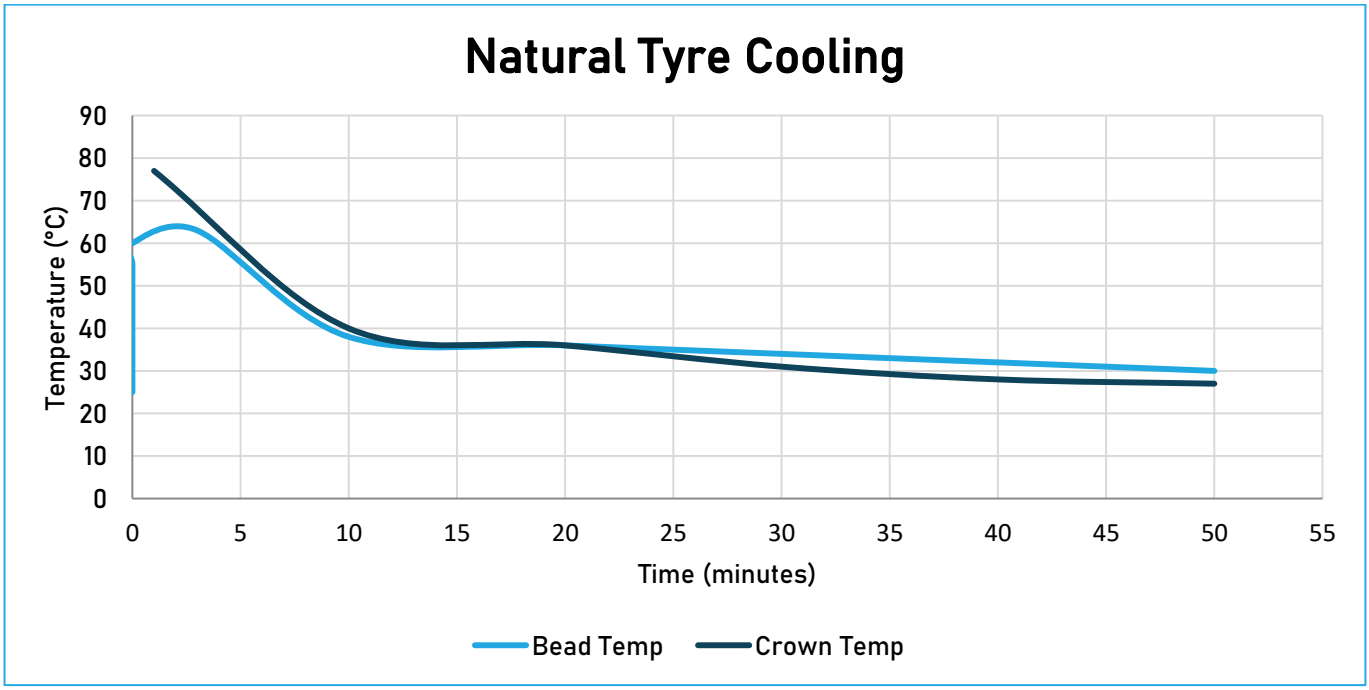

Figure 16 – Natural Tyre Cooling

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5.3 TYRE WEAR LIMITS

5.3.1 INTRODUCTION

Aircraft tyres installed on aircraft must be examined regularly for wear, as part of routine maintenance. Tyres which are worn beyond the limits specified in within the section must be removed from aircraft.

Replace any tyre which is found to be damaged the beyond specified limits within the relevant AMM, CMM or other relevant documentation, including this manual.

5.3.2 WORN TYRE REMOVAL CRITERIA

Dunlop advises that worn tyre removal criteria should be based on the type of tyre in operation, as detailed in the following sections. Tyres meeting the following definitions should be considered Worn To Limits (WTL).

5.3.2.1 RETREADABLE TYRES

Replace a retreadable tyre when it reaches any of the following limits:

- In dry conditions, the first time wear reaches the bottom of the central tread groove. If the tread pattern does not incorporate a centre groove then use the grooves immediately adjacent to the centre tread rib.
- In wet conditions, the first time wear reaches 2mm (0.080") above the bottom of the central tread groove. If the tread pattern does not incorporate a centre groove then use the grooves immediately adjacent to the centre tread rib. [Refer to CAA CAP 562 – Book 2 Leaflet 32-30]
- The first time wear exposes any fabric, unless the tyres is of a fabric reinforced tread design (see 5.3.2.3).

Any tyre having reached the above limits can perform up to an additional five flight cycles, to facilitate a return to base for removal and replacement. However, retreaded tyres operated beyond the wear limits risk no longer being retreadable.

5.3.2.2 NON-RETREADABLE TYRES

Replace a non-retreadable tyre when it reaches any of the following limits:

- The first time wear exposes any fabric, unless the tyres is of a fabric reinforced tread design (see 5.3.2.3).

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5.3.2.3 FABRIC REINFORCED TREAD TYRES

Replace a fabric reinforced tread tyre, where fabric has been incorporated into the wearing portion of the tread, when it reaches any of the following limits:

- The first time wear reaches the bottom of the central tread groove. If the tread pattern does not incorporate a centre groove then use the grooves immediately adjacent to the centre tread rib.

5.3.2.4 DIMPLE TREAD TYRES

Replace a dimple tread pattern tyre when it reaches any of the following limits:

- The first time wear reaches the bottom of a row of dimples.

5.3.2.5 TWIN-CONTACT TYRES

Replace a twin-contact pattern tyre when it reaches any of the following limits:

- The first time the centre of the crown shows signs (roughness or marks) it has been in contact with the ground.

5.3.3 TYPICAL TYRE WEAR

The following figures cover a range of typical wear patters which can be encountered during operation of aircraft tyres:

5.3.3.1 EVEN WEAR

This shows the appearance of an evenly worn tyre, with tread life remaining.

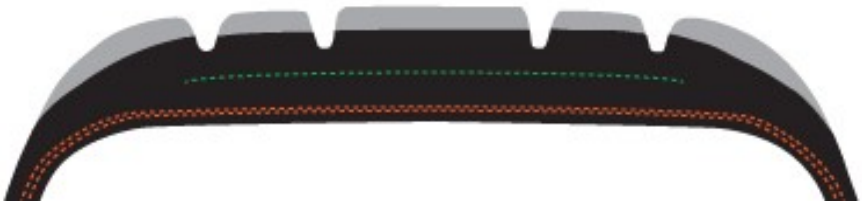

Figure 17 – Even Tyre Wear

5.3.3.2 WEAR BELOW TREAD GROOVES

This shows the appearance of an evenly worn tyre, beyond typical WTL conditions.

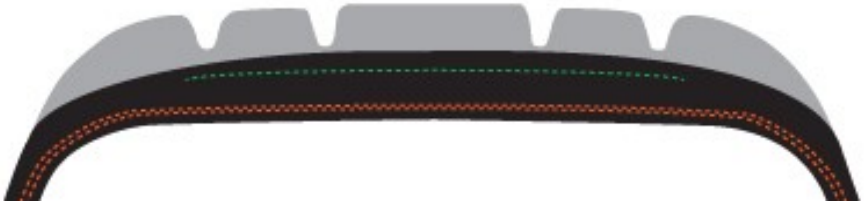

Figure 18 – Wear below Tread Grooves

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5.3.3.3 STEPPED WEAR

This shows the appearance of an unevenly worn tyre, exhibiting stepped wear. This is more prevalent in certain tyre sizes, such as “H” section tyres. Stepped wear will be made worse by under inflation.

Figure 19 – Stepped Tread Wear

5.3.3.4 SHOULDER WEAR

This shows the appearance of an unevenly worn tyre, exhibiting shoulder wear. This is normally caused by uneven loading, which can be due to under inflation, landing gear geometry or certain ground movement of the aircraft.

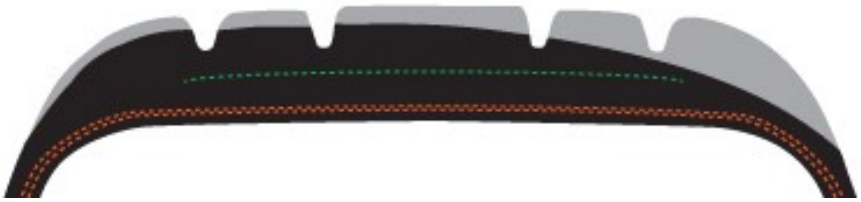

Figure 20 – Shoulder Tread Wear

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5.3.4 UNEVEN TYRE WEAR

5.3.4.1 INTRODUCTION

Various factors can have an effect of the distribution of tread wear. If uneven tyre wear is detected consider the following contributing factors.

Always follow the relevant removal criteria in 5.3.2, or in the relevant AMM.

5.3.4.2 LANDING GEAR GEOMETRY

The geometry of some aircraft is such that the tyres wear more on one side of the tread. This can be due to natural camber within the gear assembly, or on how the gears are loaded during certain movements of the aircraft on the ground, such as during tight turns.

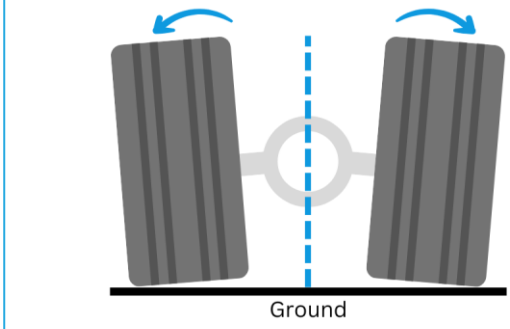

Figure 21 – Cambered Gear

Some tyres with this type of wear can be removed, turned around, and reinstalled, if the wear is not more than the specified limits given in 5.3.2, or by the relevant AMM. If you are unsure about the procedure please contact Dunlop for support.

These factors are more likely to result in uneven wear one only one side of the tyre. This wear can be referred to as “asymmetric” wear.

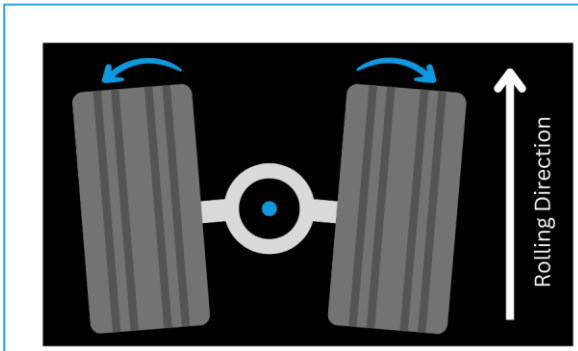

Figure 22 – Yawed Gear

Wear on landing gear can result in changes to both chamber and yaw. Camber is the angle at which the tyre meets the ground, with yaw the angle of the tyre in relation to its rolling direction.

5.3.4.3 AIRCRAFT OPERATION

Taxiing with one engine shutdown or with high speed cornering will induce yaw on the tyres and lead to asymmetric wear.

5.3.4.4 TYRE INFLATION

An incorrectly inflated tyre will not wear evenly. Over inflated tyres will tend to wear more quickly in the crown, while underinflated tyres are more likely to wear more in their shoulders.

These factors are more likely to result in uneven wear which remains symmetrical.

Always inflate tyres to the correct inflation pressure, as given in Table 2, or in the relevant AMM.

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5.4 TYRE DAMAGE LIMITS & TYRE FAILURES

⚠ CAUTION

Always approach tyres at a 45° angle from the tread, to minimise the risk of injury from tyre bursts.

5.4.1 INTRODUCTION

Aircraft tyres installed on aircraft must be examined regularly for damage and failures, as part of routine maintenance. Tyres which are damaged beyond the limits specified in within the section must be removed from aircraft.

5.4.2 RETURN TO BASE CONDITIONS

For some damage types, continued operation can be justified where additional flight cycles are required to return an aircraft to a suitable maintenance base.

Conditions where continued operation may be permitted for return to a maintenance base will be permitted at the discretion of the airframer, with Dunlop's support. Always follow the applicable AMM or related airframer requirements for suitability for continued operation.

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5.4.3 COMMON DAMAGE TYPES

5.4.3.1 DRY BRAKING FLATS

Dry braking flats occur when the tyre is locked from rotation while the aircraft is in motion over a dry surface.

Replace a tyre when any of the following limits are met:

- If normal tyre wear limits have been exceeded.
- If the flat spot causes unacceptable vibration or gear shimmy.

Figure 23 – Dry Braking Flat

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5.4.3.2 WET BRAKING FLATS

Wet braking flats occur when the tyre is locked from rotation while the aircraft is in motion over a wet surface.

This is most commonly associated with hydroplaning, where a layer of water builds between the tyre and the ground leading to loss of traction. Hydroplaning will typically result in a tyre surface which appears melted.

Replace a tyre when any of the following limits are met:

- If normal tyre wear limits have been exceeded.
- If the flat spot causes unacceptable vibration or gear shimmy.

Figure 24 –Wet Braking Flat

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⚠ CAUTION

Any tyre found with inflation pressure less than 80% of the specified operational pressure must be removed along with any companion tyre fitted on the same axel.

5.4.3.3 SHOULDER WEAR

Shoulder wear can occur where one or both tread shoulders are loaded more heavily than the crown.

There are a number of common causes for shoulder wear, including:

- Tyre under inflation. Tyre under inflation will also result in excess sidewall deflection and can also result in component separation within the tyre.
- The design of certain aircraft and their landing gear can load certain tyres unevenly.
- Due to their general shape, H section tyres are at increased risk of shoulder wear.

Replace a tyre when any of the following limits are met:

- If the tyre is found to be under inflated, per the limits specified in Table 2.
- If normal tyre wear limits have been exceeded.

Figure 25 – Shoulder Wear

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5.4.3.4 TREAD STRIP

A tread strip occurs when all or part of the tread rubber separates form the rest of the tyre. Tread strips can occur when the tyre encounters FOD or as a result mechanical or thermal fatigue associated with tyre under inflation.

Replace a tyre when any of the following limits are met:

- If a tread strip has been identified.

Figure 26 – Tread Strip

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5.4.3.5 TREAD CHUNKING

Tread chunking can occur when aircraft are turning or taxied quickly, or where aircraft are operating on rough or unprepared surfaces. Tread chunking can also occur where there is significant localised tread damage, such as a large area of chevron cuts.

Replace a tyre when any of the following limits are met:

- You can see more than 7cm^2 (1.0"^{2}) of chunking on a single tread rib.
- You can see more than 7cm^2 (1.0"^{2}) of fabric.
- The chunking extends below a tread rib.

Figure 27 – Tread Chunking

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5.4.3.6 OPEN TREAD JOINT

An open tread joint can occur when the original manufacture of the tyre fails to adequately adhere a joint in the tread.

Replace a tyre when any of the following limits are met:

- If an open tread joint has been identified.

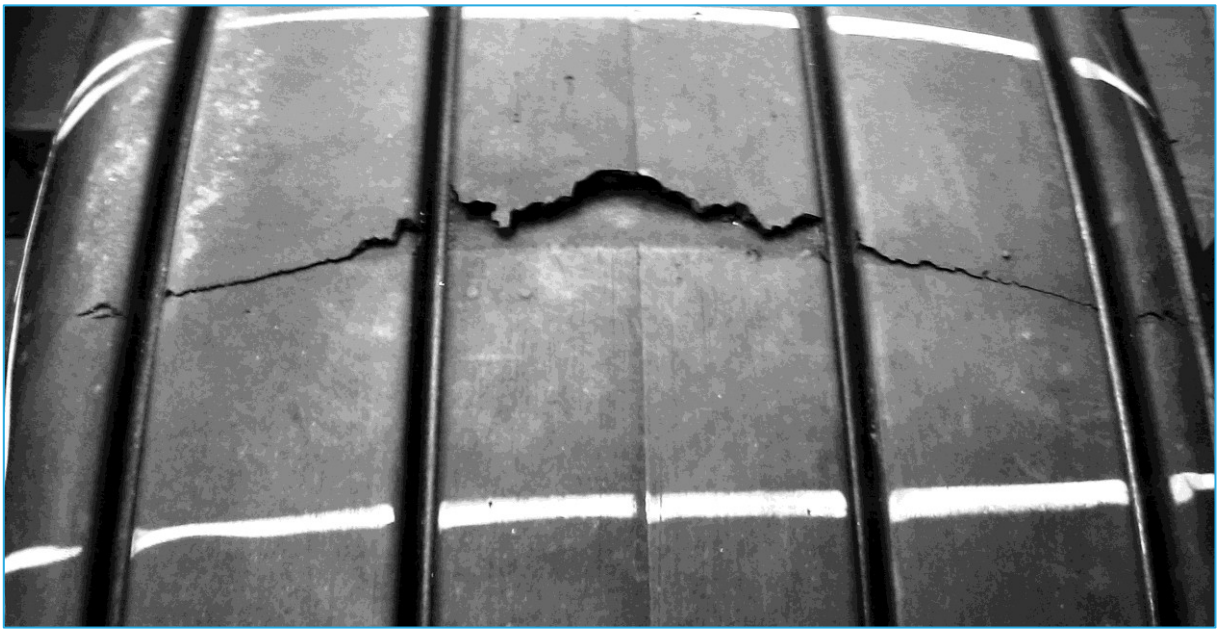

Figure 28 – Open Tread Joint

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5.4.3.7 TREAD GROOVE CRACKING

Tread groove cracking can occur where high stresses are applied through the base of the tread grooves. High groove stresses can be caused by operation of the tyre under inflated. Groove stresses are generally higher in new bias tyres due to their initial growth over the course of their first tread life.

Resistance to tread grooves cracking can be reduced by contamination.

Replace a tyre when any of the following limits are met:

- If you can see any cords through the cracking.
- If any cracking extends below a tread rib.

Figure 29 – Tread Groove Cracking

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5.4.3.8 LATERAL SCORING

Lateral scoring can occur where tyres encounter sideways or scrubbing movement in relation to the ground. This can occur during landing is cross-wind conditions or while performing tight turns, particularly during towing and push-back operations.

Where lateral scoring occurs adjacent tears can also occur in the interface between the tread and the casing. Under extreme lateral scoring this adjacent damage can lead to tread chunking or tread strips.

Replace a tyre when any of the following limits are met:

- If any associated tread chunking exceeds the limits detailed in 5.4.3.5.
- If lateral scoring and associated cuts exceed the limits detailed in 5.4.3.10.

Figure 30 – Lateral Scoring

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5.4.3.9 CHEVRON CUTTING

Chevron cutting can occur when partial contact is made between the tyre and ground at speed. This can occur during aircraft turning or braking, or during initial touch-down on landing and especially when landing on runways which are cross-grooved.

Replace a tyre when any of the following limits are met:

- You can see more than 7cm^2 (1.0"^{2}) of fabric.
- The area of chevron cutting extends beyond the tread.
- The chevron cutting extends below a tread rib.

Figure 31 – Chevron Cutting

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⚠ CAUTION

Cut damage can cause the separation of a tread rib. Immediately remove any tyres found with cut damage greater than the allowable limits detailed below.

5.4.3.10 CUT DAMAGE

Cut damage can occur where tyres encounter FOD or where aircraft are operating on rough or unprepared surfaces.

Replace a tyre when any of the following limits are met:

- Cuts extend into the casing plies.
- Cuts expose, but do not cut into the casing plies.
- Cuts have a depth in the tread of 50% or more of the original (unworn) tread depth.
- Cuts extend across more than 35mm (1.40”), or 50% of a single tread rib.

Note; most high speed application tyres will incorporate one or more ITF. Cut damage to the ITF is not covered by any limits based on cuts to the casing plies and is not necessarily cause from replacement, unless cut damage exceeds the limits detailed above.

Note; before retreading it is possible to repair some tyres with small cuts in the casing plies. Send a tyre that has small cuts in the casing plies to Dunlop for inspection and possible repair.

Figure 32 – Cuts

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⚠ CAUTION

Bulges are commonly the result of separations between tyre components. Immediately replace a tyre which shows a bulge.

5.4.3.11 BULGES

Bulges in the tread or sidewall occur where a separating forms between tyre components. Separations between tyre components can form for a wide variety of reasons, most commonly as a result of mechanical or thermal fatigue.

Replace a tyre when any of the following limits are met:

- If a bulge has been identified.

Mark the location of any bulges with wax or chalk and return to Dunlop for inspection.

Figure 33 - Bulges

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5.4.3.12 SIDEWALL CRACKING

Sidewall cracking can occur when the tyre experiences high deflection or due to the effects of weathering.

Replace a tyre when any of the following limits are met:

- If any casing cords are exposed.

Figure 34 – Sidewall Cracking

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5.4.3.13 SIDEWALL UNDULATIONS

Sidewall undulations occur where there are joins between fabric layers within the structure of the tyre. These joints are stiffer than the adjacent material and so when stretched under pressure will not stretch the same as the surrounding material, giving an undulating appearance.

Replace a tyre when any of the following limits are met:

- If the depth or height of the undulation is greater than 3mm (0.120").

Per SAE ARP6307, the depth and height of an undulation is measured in comparison with the surrounding 75mm (2.950") of sidewall, measured circumferentially. This measurement may be taken anywhere along the sidewall, from the area adjacent to the wheel to the tread edge.

Figure 35 – Sidewall Undulation

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⚠ CAUTION

A tyre burst will increase the load carried by all remaining tyres installed on aircraft. Always remove any companion tyres installed on the same axel as a tyre which has burst.

5.4.3.14 BURSTS

Bursts are the result of a failure of the tyre structure. The types of damage which can inflict sufficient damage to cause a tyre burst could be where tyres encounter FOD or where tyres are operating with low pressure for an extended period.

Replace a tyre when any of the following limits are met:

- If a burst has been identified.

The burst of any tyre will increase the load carried by all remaining tyres, especially those on the same axel. This could overload other tyres installed on the aircraft. Also remove any tyres installed on the same axel as a tyre which has burst.

Figure 36 - Bursts

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5.4.3.15 HIGH BRAKE HEAT

High brake heat can be transmitted through the wheel to the bead area of the tyre. A high braking force can generate sufficient heat to damage the tyre, although normal aircraft operation will not generate sufficient heat to damage tyres.

Replace a tyre when any of the following limits are met:

- If there are blisters on the bead rubber.
- If there are large areas of bead rubber which appear blue.
- If there are areas of the bead rubber which appear brittle.
- If rubber in the bead area has melted.

Figure 37 – High Brake Heat

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5.4.3.16 CONTAMINATION

Contamination of tyres with hydraulic fluid, fuel, oil, or grease can cause deterioration of the tyre.

Remove any tyre contamination as quickly as possible. To remove contamination use denatured alcohol to clear the contaminant and then wash the affected area with detergent and clean water.

If a tyre has been in contact with any contaminant, examine the tyre and remove it if any of the following can be identified:

- Swelling of any rubber
- Softening of any rubber
- Delamination or cracking

The following table gives further guidance on how to handle contamination of tyres:

Table 3 – Recommendation for Cleaning Contamination

Contamination Area	Level of Exposure	Recommendation
Tread or Sidewall	Up to 12 Hours	Wash as soon as possible[1]
Tread or Sidewall	12 to 48 Hours	Wash, remove & send to Dunlop/retreaded for inspection and possible repair[2]
Any Surface	Over 48 Hours	
Any Fabric	Any Period	

Notes
Clean thoroughly with denatured alcohol to remove the contaminant, then wash with detergent and clean water.
1. Ensure that the contaminated area is not damaged, as outlined above.
2. Mark any tyres being returned to Dunlop and sent to a retreaded under these conditions with "CONTAMINATED TYRE" marked on both sidewalls in white chalk/wax.

5.4.4 TYRE WHEEL SLIPPAGE

After installation of a tyre on rim, some cycles on the aircraft may be necessary before the tyre reaches its final position. During this period of time, slippage of the tyre on the rim may be observed.

In service, tyre to rim circumferential movement of up to a maximum of 20° per installation is acceptable. Assemblies than move more than this limit should be disassembled and evaluated for appropriate investigation. Circumferential movement that affects the ability of the tyre to provide an air seal with the wheel are unacceptable.

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5.4.5 VIBRATION & BALANCE

Vibration of landing gear and of tyres in particular is a common concern. There are a number of factors which can result in vibration, some that are tyre related, but many others which are based in the wider landing gear assembly.

Certain aircraft, or specific positions on certain aircraft, can be more sensitive to vibration and may require that tyre-wheel assemblies are directly balanced. Always consult the applicable AMM for guidance on balancing tyre-wheel assemblies, where required.

Instances of unacceptable vibration should be investigated to determine corrective action. If vibration is unacceptable for aircraft operation, remove the tyre-wheel assembly from aircraft for the following:

- Check the landing gear:
  - Check for damage
  - Check for loose or worn components (such as torque links, shimmy dampers, etc.)
  - Check for loose or worn hydraulics (such as steering control units)
  - Check for incorrect gear alignment
- Check the wheel:
  - Check for damage
  - Check for incorrect assembly
  - Check for loose bearings
- Check tyre-wheel assembly
  - Check the red balance spot on the tyre is aligned with the wheel valve or heavy spot on the wheel assembly
  - Check the beads of the tyre are correctly seated on the rim. Dunlop tyres are marked with one or multiple fitment lines in the lower sidewall which can be used to check for concentricity with the rim
- Check the tyre:
  - Check for damage, in particular any flat spotting, out of round, or bulges
  - Check for proper inflation pressure, as outlined in the applicable AMM or this TCMM if further guidance is required. If tyres are installed on a multi-tyre gear, check all tyres installed on the same axle
  - Check for incorrect installation, in particular if the tyre was allowed to stretch for 12 hours at operating pressure
- Inner tubes
  - Check for trapped air between the tyre and the inner tube
  - Check to ensure the tube is not wrinkled

If, operationally, there is insufficient time to change tyres for a given vibration issue, some temporary improvement may be achieved by jacking the aircraft and rotating one tyre by 180°. This may sufficiently offset imbalance to allow for continued operation.

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5.4.6 FLAT SPOTS

If an aircraft sits stationary for a prolonged time its tyres can become temporarily flat spotted (where the tyre takes on an out of round shape). This effect can be worse during cold weather.

Flat spots are usually removed during aircraft taxiing, although flat spotted tyres can lead to increased gear vibration. If a flat spot leads to unacceptable gear vibration, remove the tyre and return to Dunlop for retreaded or inspection and repair.

If aircraft are to be stored for a prolonged time, tyre flat spots can be minimised/avoided by regularly moving the aircraft a short distance, or placing the aircraft on jacks so that the tyres are no longer in contact with the ground.

⚠ CAUTION

Exercise additional caution around inflated aircraft tyres having experienced abnormal high energy operations. Always wait a minimum of 30 minutes for tyres to cool before inspection following abnormal high energy operations.

5.4.7 REJECTED TAKE-OFF, OVERSPEED LANDING & OVERLOAD

Tyres subjected to abnormal high energy operations, such as during a rejected take-off, an overspeed landing or an overload event can be damaged beyond acceptable limits for continued service.

If any of the following conditions are met during abnormal high energy operation the tyre should be removed, condemned, marked “RTO”, “Overspeed” or “Overload”, as applicable, and returned to Dunlop for examination:

- If aircraft ground speed exceeded tyre rated speed
- If aircraft ground speed did not exceed tyre rated speed, but high brake energy was applied
- If tyre load is known to have exceeded tyre rated load
- If fuse plugs were blown

For any other abnormal operation consult the applicable AMM or other relevant requirements.

5.5 MIXABILITY OF AIRCRAFT TYRES

Mixability of aircraft tyres is the ability to install various approved tyres, or tyres of various approved conditions, on the same aircraft at the same time.

Limitations on tyre mixability are given by the airframer, and should be covered in the relevant AMM or related documentation.

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⚠ CAUTION

Always approach tyres at a 45° angle from the tread, to minimise the risk of injury from tyre bursts.

Exercise caution at all times around inflated aircraft tyres. Aircraft tyres are typically inflated to high pressures and if improperly handled can pose a risk of serious or fatal personal injury, and/or damage to aircraft and equipment.

Aircraft tyres should be uninstalled only as per the applicable instructions, with the correct equipment and operator training.

Do not attempt to investigate damaged tyres while inflated.

6.1 TYRE DISMOUNTING INSTRUCTIONS

Aircraft tyres should only be dismounted (disassembled from an applicable aircraft wheel, with or without an inner tube), per the specific instructions provided from the original aircraft manufacturer or original wheel manufacturer.

Always refer to the applicable AMM's, CMM's or other relevant documentation as applicable.

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7 INNER TUBES CONTENTS

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7.1 INTRODUCTION

Some aircraft tyres still require the fitment of an inner tube. Although Dunlop does supply tubes with tube type tyre still manufactured, Dunlop no long manufactures tubes directly.

On tyres where an inner tube is required, grey or silver ink/paint is used to indicate the positions of all vent holes. These vent holes are made fully through the tyre casing and allow for the release of diffused inflation gas caught between the tube and the inner surface of the tyre. The holes also allow for the release of any air trapped in the casing during the tyre manufacture.

7.2 TUBE MARKINGS

Marking on tubes supplied by Dunlop include:

- Tube date, as either:
  - A date code (e.g. JUN 99)
  - Year/month, day of month, or production number code
- Manufacturer
- Tube size (tube size is specified the same as the tyre it is designed to be installed with)
- Part number
- Issue number
- Stores ID number

Other markings can be included, dependant on specific tube part number.

7.3 RECEIVING & STORAGE OF TUBES

It is best to keep a tube within the packaging in which it was supplied. It is not necessary to examine a tube which is still within its packaging, unless that packaging is damaged. If the packaging is damaged, examine the tube as detailed in 7.4.

Alternately, tubes can be stored inflated to a low pressure within a tyre of the correct size.

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7.4 INSPECTION OF TUBES

Inspect tubes for signs of any of the following damage:

7.4.1 TUBE CHAFING

Movement of the tyre in relation to the wheel can cause chafing of the tube against the bead toes of the tyre, or it can cause damage to the valve. Examine any creep marks painted on the tyre and wheel. If the creep is more than 25mm (1.0") the tube should be replaced.

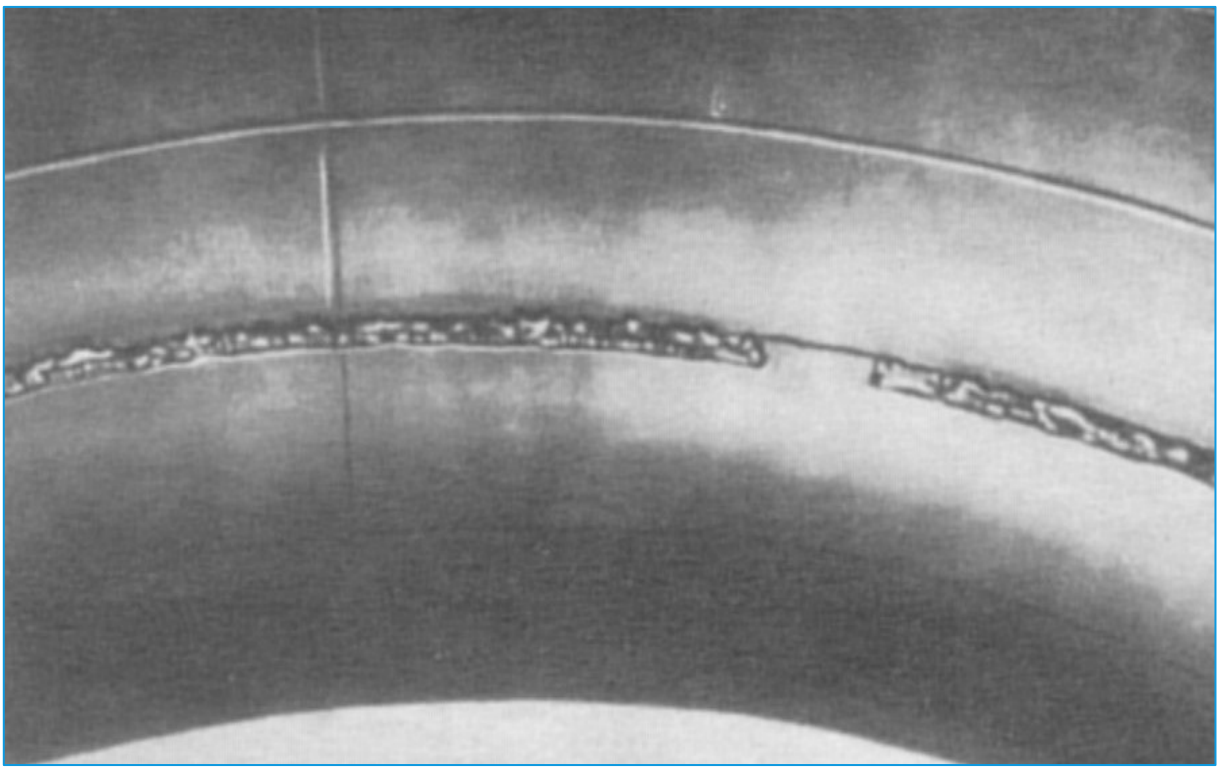

Figure 38 – Tube Chafing

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7.4.2 TUBE CREASING

Tube creasing is caused by localised folding of the tube within the tyre. The following factors are known to increase the risk of tube creasing:

- Incorrect installation
- Where pressure is decreased after a tube and tyre have been overinflated
- Where a tyre is over-deflected (such as when wheel fuse plugs are blown)

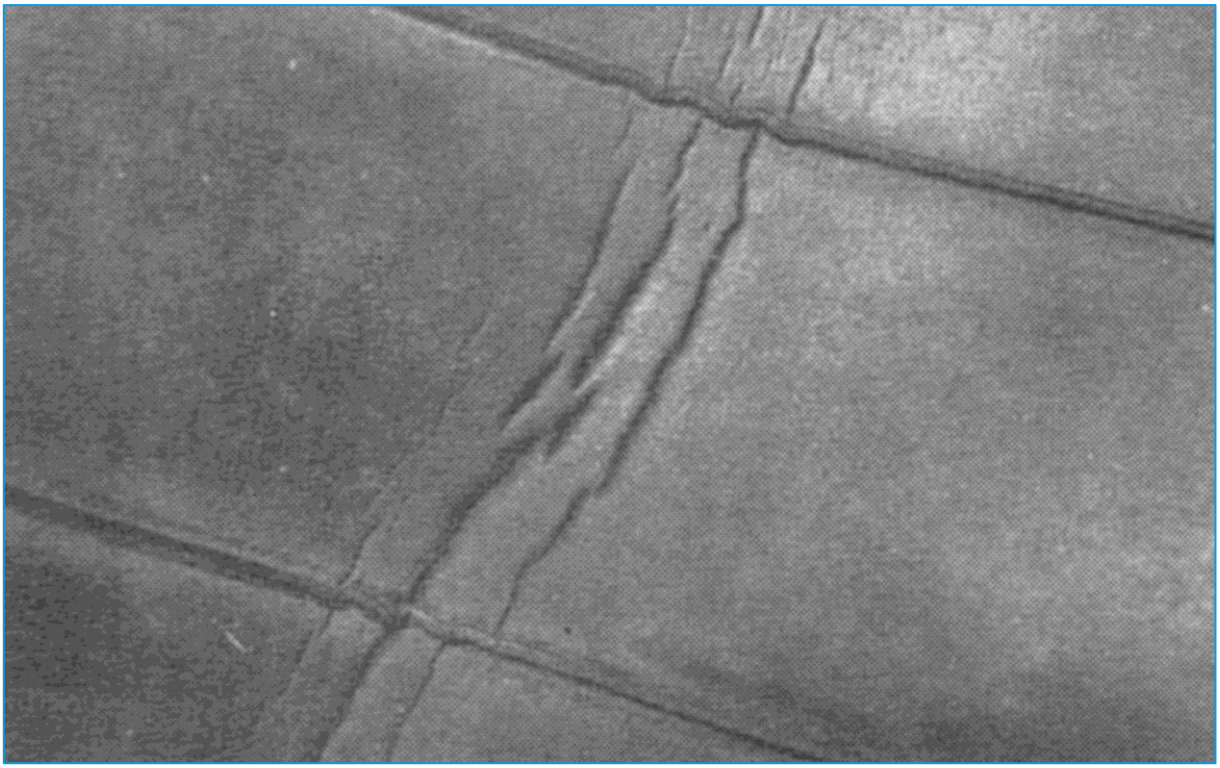

Figure 39 – Tube Creasing

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7.4.3 TUBE CRACKING

Tube cracking occurs where the structure of the rubber begins to break down and become brittle at the surface.

To examine a tube for cracking:

- Hold the rubber between thumb and finger and apply pressure
- Pressure on rubber should cause it to locally flex, any cracking will visible as the rubber locally flexes

Replace any tube with cracking if the cracking is deeper than surface level (where the cracking extends into the rubber of the tube).

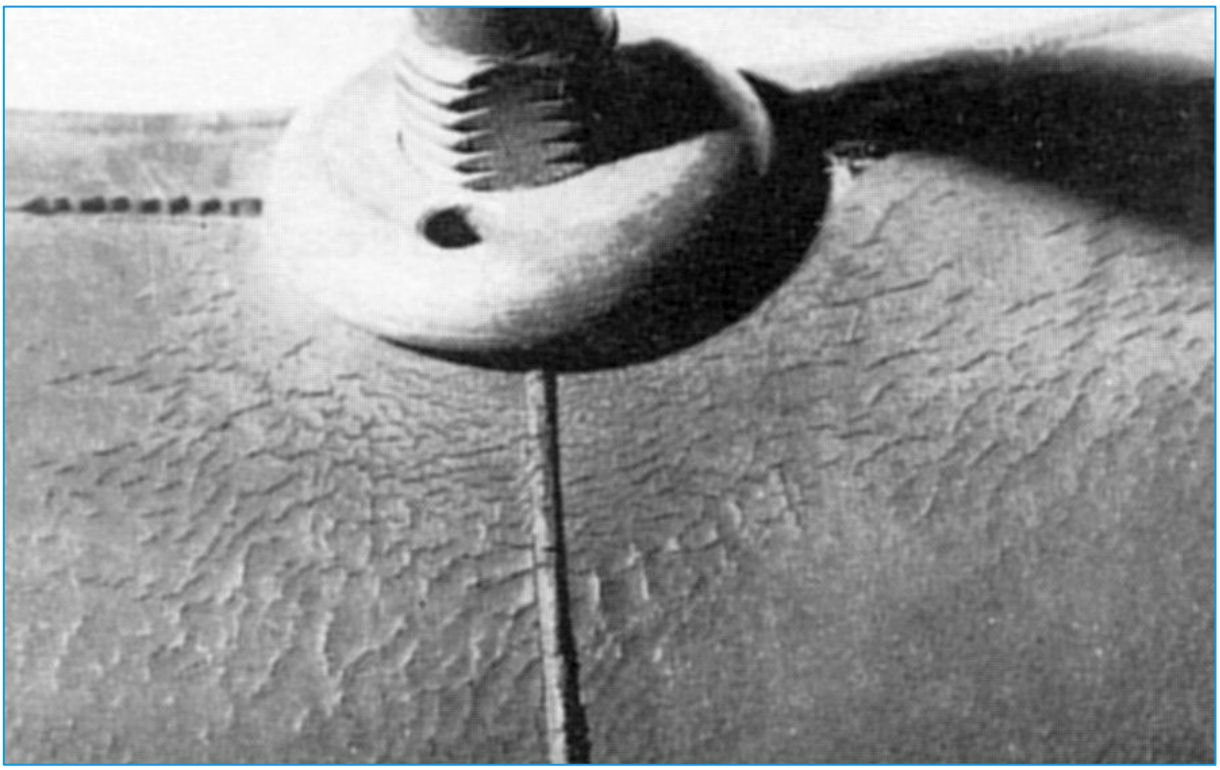

Figure 40 – Tube Cracking

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⚠ CAUTION

Use the correct safety equipment to prevent inhalation of French chalk or talc.

7.5 INSTALLATION OF TUBES

Before installing an inner tube, examine it for damage or contamination. Reject any tubes that show signs of cracking or splitting at the bottom of the valve stem, or creasing anywhere around the tube. If uncertain of the serviceability of an inner tube please contact Dunlop for support.

To install an inner tube to an aircraft tyre:

- Apply French chalk or lubricating talc to the inner surface of the tyre. Shake the tyre to remove excess chalk or talc
- Align the heavy spot on the tube (if there is a red stripe on the tube to mark this), or alternately the tube valve stem, with the light spot on the tyre (where there is a red mark on the sidewall)
- Carefully place the tube within the tyre. Run a hand around the tube to ensure it is smooth and that there are no creases or folds. This will also help to minimise any air caught between the tube and the tyre
- Complete the assembly of the tyre to the wheel, per the relevant AMM/CMM or relevant instructions
- Inflate, and then deflate the tube and tyre. This will help to remove air from between the tube and tyre via. This will also help the tube to expand correctly, so that it is not creased or pinched in the bead toe

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